

## MALARIA CONTROL AT THE DISTRICT LEVEL IN AFRICA: THE CASE OF THE MUHEZA DISTRICT IN NORTHEASTERN TANZANIA

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**Abstract.** An assessment was done in Tanzania to determine the extent to which the primary health care services have contributed to reducing the burden of malaria since the system was initiated in the 1980s. Seven descriptive processes and outcome indicators of effectiveness were used: changes of malaria transmission and incidence over time; use of facility-based care services for malaria; patients' access to professional advice; the trend of treatment failure over time of sulfadoxine-pyrimethamine and chloroquine; survival rates of severe cases at the district hospital; a district malaria control strategy; number of malaria specific training for care providers; and the number of activities carried out on mosquito control measures. The data were collected from 1996 to 2003 in the Muheza district northeastern Tanzania. It covered household interviews with a stratified sample of 1,250 respondents, and in-depth interviews with all 175 health care providers in the 35 health facilities within the district. All six members of the district health management team were also interviewed. Additional data came from dispensary and hospital records, and published literature. The results show an unchanged malaria disease burden. The average number of clinical malaria episodes per child less than five years of age remained between 3 and 3.5 episodes per year in the district since the 1960s. The comparison of cases expected in the population less than five years old with those seen in the district health facilities shows a coverage rate of 33%. Furthermore, between 1990 and 2003, little training on malaria was provided to health staff. The findings imply a limited effectiveness of district health services on malaria control, suggesting a weak process of translating national malaria goals to activities at the district level.

### INTRODUCTION

Following the failure of vertical malaria control programs in most countries during the 1960s and 1970s, the 38th World Health Assembly in 1985 adopted a resolution recommending that malaria control activities be developed as an integral part of primary health care systems at the district level.<sup>1</sup> The operational responsibilities of malaria control were transferred to the district level under the guidance of ministries of health. The development of approaches and techniques for each district, and possibly each community within the district, was to be based on the stratification of malaria epidemiology.<sup>2</sup> In addition, use of locally developed and appropriate control measures was emphasized, taking into account technical, social, behavioral, and economic factors.

The organizational issues to be considered included 1) better delineation (stratification) of the malaria problem, including a more precise definition of areas with different levels of endemicity, precise definition of populations at risk, and better understanding of the factors influencing mosquito borne diseases in different situations; 2) improved understanding of cost-effective measures appropriate for different situations, their timing, and sequencing of their application; 3) improved understanding of how technically appropriate measures can be organized and how acceptable they are within different community settings; 4) improved sensitivity on the part of health workers to factors that can enhance job performance, including recognition of high-risk situations/populations, selection of measures applicable to different settings and health education; and 5) and enhancing community participation.<sup>1</sup>

This change of strategy from a vertical control program to an integrated primary health care approach had wide implications for the organization of the primary health care system. For example, the role of primary health workers within the

district was made more complicated as tasks were added. It was clear that for the strategy to succeed, re-training and re-deployment of primary health workers at all levels was crucial. The training and deployment had to be considered not only in general terms, with respect to epidemiology and control of malaria, but also in very specific terms, particularly at the field level, in relation to duties to be carried out for malaria control by health workers.

Primary health care through the District Health Services (DHS) has an important role in the control of malaria.<sup>2</sup> The provision of prompt diagnosis and treatment of cases, prophylaxis for risk groups, provision of health education to the affected communities, coordination of vector control activities, and monitoring of epidemics are some of the pivotal roles that the DHS can play. Prompt diagnosis and treatment reduce malaria transmission by decreasing the duration of illness and eliminating parasite reservoirs in the general population.<sup>3</sup> This report presents the results of a study analyzing the effectiveness of the DHS in the Muheza District of Tanzania regarding malaria control.

### MATERIALS AND METHODS

**Study area.** The Muheza District is one of the seven districts in Tanga region in northeastern Tanzania. The district has 35 wards with a population of 279,423.<sup>4</sup> An average ward has approximately 8,000 people. The population growth rate is 1.8% compared with the national average of 2.9%.<sup>4</sup> The infant mortality rate is estimated to be 133/1,000,<sup>5,6</sup> which is 27% higher than the national figure of 104/1,000.<sup>7</sup> Mortality in children less than five years old in the Muheza District is 208/1,000,<sup>8</sup> which is 26% higher than the national average of 165/1,000.<sup>9</sup> The district has 32 dispensaries, 3 health centers, and 1 district hospital.

Malaria is stable, intense, and perennial in Muheza with transmission peaking after the rainy season in May and June. It occurs throughout the district with the exception of few pockets in the eastern Usambara Mountains. Malaria is the leading cause of hospital admissions at the district hospital and, at the village level, fever and malaria combined account for 83% of all deaths in children less than five years of age.<sup>8</sup> *Plasmodium falciparum* is the main causative agent, accounting for more than 90% of all the infections. Determinants of the epidemiology and clinical impact of malaria for the Muheza District are ecology, transmission, and immunity. Transmission depends largely on the favorable ecologic conditions (hot and humid, the presence of clear water bodies in the lowland and coastal part of the district that are favorable for anopheline mosquitoes), which increase the vectorial capacity.<sup>10</sup> Throughout the district and similar to other malaria-endemic areas, immunity to malaria varies by age.<sup>11</sup> At birth, children have acquired immunity from their mothers.<sup>12</sup> They are not only protected against clinical disease, but can also clear infection spontaneously following infective bites. This immunity is lost rapidly within three months and children develop their own immunity slowly over time. On average, 60–80% of the children 1–10 years of age are malaria blood smear positive and each child experiences up to five episodes of clinical malaria per year.<sup>13</sup>

Although the pattern of other diseases varies greatly in the region, the top five diseases in terms of mortality in the Muheza District are malaria, measles (for children), pneumonia, anemia (much associated with malaria), and diarrhea.

**Main components of the study.** *Effectiveness indicators.* The selected DHS effectiveness indicators on malaria control in the Muheza District, the sources of data, and the time frame for data collection are shown in Table 1. The data collected cover the following performance indicators.

**Change of burden of disease: incidence of malaria over time.** In this study, the assessment of the extent to which the national objective (reduction of transmission and morbidity due to malaria)<sup>14</sup> has been attained was done by reviewing

three-linked malariometric indices: sporozoite rates, incidence of malaria cases, and prevalence to estimate the extent of reduction of malaria burden over time.

**Sporozoite rate.** One of the most important epidemiologic parameters for the assessment of malaria transmission is the frequency of female anopheline mosquitoes with salivary glands infected with malarial parasites, a measure usually called the sporozoite rate.<sup>15</sup> The relationship between malaria transmission intensity and disease burden is poorly understood and has recently been the subject of considerable debate.<sup>15,16</sup> The evidence indicates that malaria prevalence and incidence and malaria-attributable morbidity and mortality all increase with transmission intensity.<sup>15,17,18</sup> The proportion of mosquitoes that are infectious at any given time fluctuates inversely with their emergence rate, reflecting changes in the age distribution of the mosquito population.<sup>15</sup> Sporozoite rates for the period of 1934 to 2002 are reviewed in this assessment.

**Incidence of malaria cases and parasitemia prevalence in children less than five years of age.** The prevalence rates of malaria parasitemia between 1933 and 2003 and the malaria incidence in children up to five years of age were the two basic indicators used for describing the occurrence of malaria in the Muheza District and the measure of DHS effectiveness in reducing malaria burden over time.<sup>19</sup> Although prevalence alone indicates neither when the persons were initially infected nor which previously diseased persons subsequently recovered or died, it is still a good measure of the overall level of malaria illness (disease burden) in any given setting. The data on incidence from studies carried out in the Muheza District since the 1970s are used. The analysis of the incidence data in this study is restricted to new cases in children less than five years of age from clinical trials of proguanil-dapsone, sulfadoxine-pyrimethamine, and chloroquine carried out in The Muheza District in the 1980s and 1990s. The rates (number of episodes per person per year) show how many new cases of malaria occurred in a population during a specified interval of time.

TABLE 1  
Summary of indicators, data sources, and sample sizes\*

Indicators	Data type and source	Samples size
Malaria incidence	Published literature of studies done in Muheza district between 1930s and 1990s	Varied
Use of services	DHS facility records Questionnaire Interviews (1996)	A sample of 5 DHS rural facilities A random sample of 1,250 respondents from a stratified (geographic) sample of 15 villages
Malaria case fatality rates	Teule Hospital Annual Reports (1989–2002)	All 6 members of DHMT
District malaria control strategy	Interview with members of DHMT staff in DHS facilities. Workshop discussion (1996)	178 staff of DHS facilities 21 workshop participants from the district
Training provided to DHS staff on malaria	Review of records in the district office Interview with DHS staff and DHMT members, workshop discussion (1996)	All 6 members of DHMT 178 staff of DHS facilities 21 workshop participants from the district
Use of professional advice	Questionnaire interview	A random sample of 1,250 respondents from a stratified (geographic) sample of 15 villages
Resistance of malaria parasites to anti-malarial	Literature review of studies done in Muheza District (1980–1990s)	All 6 members of DHMT
Vector control activities	Review of records in the district office Interview with DHS staff and DHMT members, workshop discussion (1996)	178 staff of DHS facilities 21 workshop participants from the district
Malaria diagnosis facilities	Observation with checklist	All DHS facilities (excluding District Hospital)

\* DHS = District Health Services; DHMT = District Health Management Team.

**Coverage: health service use in relation to malaria.** Use of health services for malaria was estimated on the basis of proportion of children up to five years of age in need of malaria treatment who received services between 1993 and 2003. The sample was derived from case records in four village communities (Ubwari, Kicheba, Mkanyageni, and Umba) served by the Muheza DHS. The estimate is based on the minimum standard of coverage defined as three malaria episodes per child per year. The number of malaria-like episodes (acute febrile illness with or without blood smear confirmation) per child per year was obtained from questionnaire interviews (Table 1) in which respondents ( $n = 1250$ ) were asked to recall the number of episodes experienced by each child less than five years of age in a household during the previous 12 months. The results were also corroborated with two previous clinical studies in Muheza.<sup>11,12</sup> The number of cases are compared with the total population of children up to five years of age in each of the four areas (estimated on the basis of 2002 National Census).<sup>4</sup> The use of services was used to estimate the effectiveness of the Muheza DHS on malaria in relation to service needs and coverage.

**Patient access to professional advice.** Community access to professional medical advice from the Muheza DHS facilities was used as an indicator of effectiveness in terms of service coverage. The assessment of use and appropriate sources for medical drugs including anti-malarials, was done through a questionnaire interview (Table 1). In the interview, respondents were asked to elicit the sources of advice on how to obtain appropriate anti-malarial drugs and how to use them.

**Aversion of death: malaria case fatality rates in the district hospital.** Annual malaria case fatality rates in the district hospital (Teule), for the period of 1989–2003 were calculated as the proportion of persons who died of malaria each year divided by those who were admitted and diagnosed as having malaria. The data was retrieved from the hospital's annual reports. To assess the changes in malaria case fatality over time and relative to overall hospital death rates, the malaria case fatalities are compared over time as well as with case fatality rates for other causes of death in the hospital during the same period. Case fatality rates are used in this study as indicators of effectiveness of DHS in death aversion. The quality care for acute cases at the hospital level is used as proxy for performance of the district referral system.

**Local malaria control strategies.** Development and use of local disease control strategies reflecting local needs and environment has been used as an indicator of effectiveness in most primary care reviews.<sup>20</sup> The reviews cover approaches and techniques developed within the district to control malaria. The process involved review of district health plan documents. Furthermore, interviews were carried out with all six members of the District Health Management Team, as well as with, 175 staff working within the rural DHS facilities in 1996–1998.

**Training of health care providers.** Provision of regular on-the-job training is part of resource management and it is an important indicator of DHS effectiveness for four main reasons: training<sup>21</sup> 1) maintains and improves competence (i.e., knowledge, skills, and attitude), 2) improves satisfaction among the care providers by reducing anxiety engendered by difficult and unfamiliar cases, 3) acquaints staff with common goals and strategies, and 4) improves community satisfaction.

Data was obtained from interviews with health workers (175) and the district health management team (Table 1).

**Sulfadoxine-pyrimethamine and chloroquine treatment failures.** A number of studies in Tanzania have documented that resistance of malaria parasites to anti-malarial drugs is, among other things, related to *ad hoc* use and inadequate monitoring of use of drugs by the DHS system.<sup>3</sup> Development of parasite resistance against anti-malarials is regarded as an indicator of the extent to which the health services are unable to monitor, regulate, and rotate the use of drugs at the community level. The range of factors known to aggravate the development of anti-malaria drug resistance include political factors in decision-making affecting changes in drug policy, use and misuse of anti-malarial drugs at the community level, lack of a system to develop surrogate markers for drug resistance, lack of flow charts to recognize treatment failure in the clinical setting, leakage of drugs from the public to the private sector, variation in drug costs between outlets in the formal sector, treatment affordability, usefulness of available tools for detecting drugs in blood and urine, validations of the patient's history of drug usage, and monitoring drug quality and availability.<sup>22</sup> The review in this study covers the period between 1970 and 2003. Rapid onset of the parasite resistance to the two most commonly used anti-malarials, sulfadoxine-pyrimethamine and chloroquine, was used as a proxy for the effectiveness of the DHS capacity to restrict and regulate the use of available anti-malarials.

## RESULTS

**Change of disease burden over time.** Figure 1 shows a remarkable decrease in sporozoite rates found in *Anopheles gambiae* and *An. funestus* in the Muheza District between the 1930s and the mid 1970s. This success is attributable to effective use of chloroquine treatment.<sup>15</sup> These gains were lost in the latter part of the 1970s, and followed by a sharp increase in sporozoite rates between 1980 and 2003. A study conducted in the district in 2001 linked this increase to uncontrolled use of anti-malarial drugs, which became abundant in non-hospital settings in the 1970s, and led to a rapid development of resistance to chloroquine and sulfadoxine-pyrimethamine in *P. falciparum* in the district.<sup>23</sup>

The parasite prevalence rates in children five years of age or younger in the district have also remained constant and at a high level from 1930 to 2003. In 2002, average parasitemia rates of 80–90% were reported in children up to five years of age. These rates were similar to those reported in 1933 (Fig-

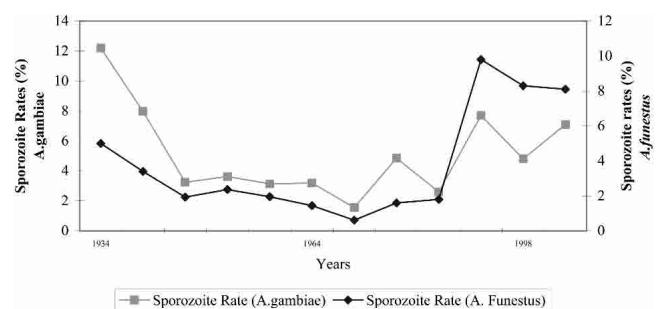


FIGURE 1. Sporozoite rates (%) in *Anopheles gambiae* and *Anopheles funestus* in the Muheza District of Tanzania, (1934–2003). The sources reviewed were Mboera and Magesa<sup>15</sup> and Mboera.<sup>35</sup>

ure 2), suggesting a high and unchanging reservoir of infection in children less than five years of age in the Muheza District over time.

The incidence (number of episodes per child per year) of clinical episodes of malaria in children aged between 0 and 60 months of age has also remained unchanged from the 1960s to 2003. The studies providing malaria incidence rates date back to late 1960s.<sup>24</sup> Clyde in 1967 reported incidence of 3.3 episodes per child per year in a cohort of 120 children (<5 years of age) followed for one year.<sup>25</sup> In 1988, a study following a cohort of 109 infants found a huge one-year mean infection episode rate between 6.6 and 7.<sup>26</sup> Data collected from the district in 1991, analyzing a cohort of 998 children followed-up for two years, reported 3.95 malaria episodes per child per year in children less than five years of age.<sup>11</sup> Similar but slightly higher figures (4.73 episodes) were reported in 1996 in a cohort of 267 children of the same age group followed-up for one year.<sup>13</sup> A new study conducted in 2002 reported a range of 3–5 episodes per child per year.<sup>5</sup> These studies show no changes in the mean number of malaria episodes, which remains more than three per child per year since the 1960s. These data on malaria incidence and prevalence rates suggest the limited effectiveness of the prompt diagnosis and treatment strategy currently used for malaria control in the district. Similar findings have been reported elsewhere in Tanzania.<sup>27</sup>

**Health service use in relation to malaria.** Figure 3 shows the number of children less than five years of age who were recorded as having malaria in four village communities (Ubware, Kicheba, Mkanyageni, and Umba) in the Muheza District served by the DHS. The numbers of cases are compared with the total population of children less than five years of age in the four areas (estimated on the basis of census projection).<sup>4</sup> The number of cases seen in the four facilities is further compared with the number of children of the same age in need of care. The results show that 38% (1993), 36% (1994), 28% (1995), 32% (1996), 33% (1998), and 34% (2003) of all the estimated number of malaria episodes in children less than five years of age were seen in the DHS facilities. The results show an average coverage of 33.1% during the years reviewed.

**Professional advice on anti-malarials.** The results on the proportion of people who, in the community questionnaire

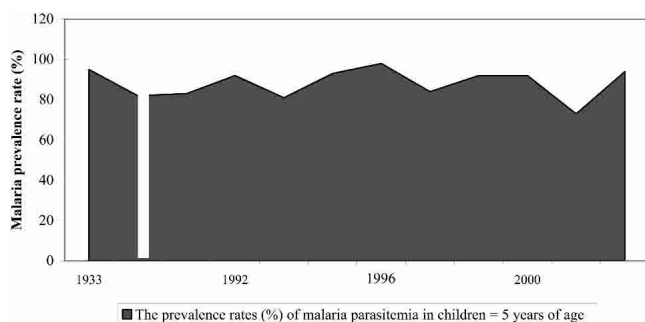


FIGURE 2. Prevalence rates (%) of malaria parasitemia in children  $\geq 5$  years of age in the Muheza District of Tanzania (1933–2003). The sources reviewed were Malina,<sup>36</sup> Maxwell and others,<sup>37</sup> Mutabingwa and others,<sup>38,39</sup> Lemnge and others,<sup>40</sup> Bernhard and others,<sup>41</sup> Ellman and others,<sup>42</sup> Warsame and others,<sup>43</sup> Magesa and others,<sup>44</sup> Matola and others,<sup>45</sup> Mnzava and others,<sup>46</sup> Mutabingwa and others,<sup>47</sup> Matola and others,<sup>48</sup> and Lelijveld and Mzoo.<sup>24</sup>

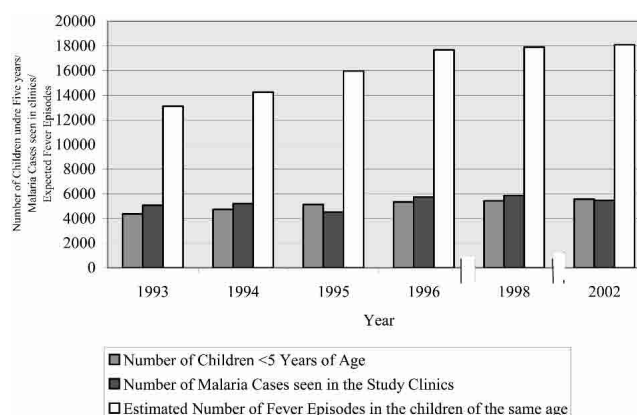


FIGURE 3. Use of district health service facilities for malaria among children less than five years of age in four villages in the Muheza District of Tanzania.

survey, reported receiving professional medical advice from the DHS facilities on how to use anti-malarials are shown in Table 2. The data show that in the six divisions within the district, a limited number of people (median = 5%, range = 2.5–13%) seek professional advice on how to use anti-malarial drugs bought from local shops. A minor variation was observed between divisions, with the lowest being 2.5% in the most remote division (Mkinga).

**Regulation of drug use: development of drug resistance.** We reviewed data on the trend in the development of malaria parasite resistance against sulfadoxine-pyrimethamine and chloroquine, the two main anti-malarials used in the district. The results on sulfadoxine-pyrimethamine are shown in Figure 4. The proportion of treatment failures is shown in two separate studies to be more than 80% between 1995 and 1997.

Resistance to chloroquine in Muheza was first documented by the reported resistance rate of 5% reported by Clyde.<sup>28</sup> The same level of resistance was reported in another study in 1966.<sup>29</sup> In 1970 Lelijveld and Mzoo reported a resistance rate of 10%.<sup>24</sup> Later in 1975, Goosen<sup>30</sup> demonstrated that the 10 mg/kg dosage of chloroquine used to treat malaria cases could no longer clear asexual parasitemia, and a dose of 20 mg/kg was recommended. In 1985, the median *in vivo* resistance to chloroquine in school children documented by Kilimali and Mkufya was 20%.<sup>31</sup> Mutabingwa and others later reported a resistance rate of 80% in infants, 58% in children 1–5 years old, and 50% in children 6–10 years old.<sup>32</sup> Similar results were reported by Rønn in 1997, who showed a resistance rate of 70% in children less than five years of age.<sup>33</sup> Overall, the review shows a high level of treatment failures for cases treated with chloroquine in the period from 1995 to 2003.

**Malaria control strategy: assessment matrix.** Table 3 shows an assessment matrix for activities associated with malaria control in the Muheza District. The matrix assesses the organizational issues of malaria control in Muheza using an index recommended by the World Health Organization for district levels.<sup>1</sup> None of the dispensaries had malaria control guidelines or plans developed by dispensary staff in collaboration with the District Management Teams. Malaria control posters on the cause and treatment of malaria were available in 12 (36%) of the DHS facilities. These posters were developed by the Ministry of Health at the national level and no local examples or production posters were used. With the exception

TABLE 2  
Professional advice sought by the patients with malaria symptoms visiting local clinics

The type of advice sought	Muheza Mjini (n = 180)	Ngomeni (n = 197)	Bwembere (n = 178)	Kisiwani (n = 168)	Mkinga (n = 164)	Maramba (n = 192)
Diagnosis of symptoms and treatment	150 (75%)	168 (84%)	150 (75%)	150 (75%)	147 (73.5%)	153 (76.5%)
Suggestions of appropriate sources for purchasing antimalarials	20 (10%)	14 (7.0%)	16 (8%)	11 (6%)	12 (6%)	13 (6.5%)
Use of antimalarials bought from non-pharmacy shops	10 (5%)	15 (7.5%)	12 (6%)	7 (3.5%)	5 (2.5%)	26 (13%)

of Muheza town, where during the last 10 years there have been activities related to mosquito source reduction (draining of breeding sites), there were no other vector control activities co-coordinated through DHS during the study period.

**Training of health workers.** The data from the 35 rural DHS facilities in the district cover a five-year period (1991–1996) and were obtained from record reviews as well as interviews of staff in the facilities visited (Table 4). The foci for regular job training were immunization, family planning, acquired immunodeficiency syndrome (AIDS) control, essential drugs, and record keeping. Of 178 respondents (i.e., staff members working in health centers and dispensaries) no one had attended on-the-job training exclusively on management and control of malaria, a disease that accounts for more than 80% of all deaths of children less than five years old.<sup>9</sup> Only limited aspects of malaria diagnosis and treatment were included in the essential drugs program courses offered during the stated period.

**Malaria case fatality rates in the district's main hospital.** Table 5 shows the overall number of deaths at the district hospital between 1989 and 2002. The data on deaths due to malaria during the same period are also shown. The results indicate an increase in case fatality rates from 36 deaths per 1,000 people in 1989 to 67.8 per 1,000 people in 1996. No change was observed in malaria deaths as a proportion of all hospital deaths between 1998 and 2002.

## DISCUSSION

The target for malaria control in Tanzania from 1982 has been to foster national and international collaborative activi-

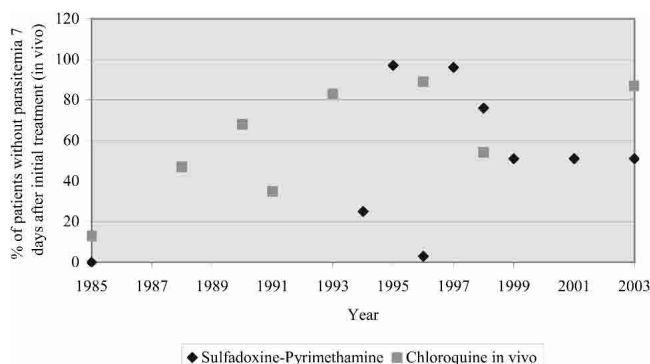


FIGURE 4. Sulfadoxine-pyrimethamine and chloroquine resistance in the Muheza District of Tanzania (1985–2003). The sources reviewed were Kilmali and Mkufya,<sup>49,50</sup> Mutabingwa and Malle,<sup>51</sup> Irare and others,<sup>52</sup> Mutabingwa and others,<sup>32</sup> Fowler and others,<sup>53</sup> Kilimali and others,<sup>54</sup> Rønn,<sup>55</sup> Trigg and others,<sup>55</sup> Msangeni and others,<sup>56</sup> Warsame and others,<sup>23</sup> Mutabingwa and others,<sup>38,39</sup> Magesa and others,<sup>57</sup> and Lemnge and others.<sup>58</sup>

ties with three aims: 1) to develop programs to prevent and control malaria by 1986, 2) to have a countrywide program for malaria control that will reduce the annual morbidity to less than 1%, and 3) to introduce measures to prevent the re-establishment of malaria in all malaria free areas by 1989.<sup>6</sup> These aims reflect broader international efforts co-coordinated by the World Health Organization (Seventh General Program of Work 1984–1989, World Health Organization, Geneva, 1982). The present study assessed the performance of DHS in relation to malaria at the district level to determine the degree to which these national and international targets were translated into programs and activities. The study also aimed to assess how robust DHS are in coping with local health problems.

Prior to the 1980s, malaria control in Tanzania was one of several vertical programs organized by the Ministry of Health. However, in the 1980s, the management paradigm shifted from the centrally managed program at the national level to locally managed programs at the district level. The operational difficulties in coordinating vertical malaria control activities led to the integration of malaria control functions within the DHS program. This shift transferred the functions of planning and budgeting authority, control of financial resources, and responsibility for implementation of malaria control programs to the district level. Thereafter, the DHS staff were expected to develop their own malaria control strategies and operational activities as part of district health planning.

The integration of malaria control activities into the district routine planning process was considered an end in itself rather than a means to achieve the larger objectives of improving efficiency of malaria control activities.<sup>34</sup> As a result, while objectives for malaria control within the DHS were explicit (for instance, to half the number of deaths among the children less than five years of age by 1995), there was not a complementary implementation strategy to achieve the intended goal. There was also the broader problem of low priority accorded malaria preventive measures such as vector control within the district health systems. Our review of the training support provided to the staff at the district level working in malaria control is further evidence of the low priority given preventive measures of malaria control in 1990s compared with other communicable disease problems within the district.

These findings show that malaria presents one of the biggest challenges to DHS effectiveness in the Muheza District. The data show a growing trend of resistance for anti-malarials used within the DHS, unchanging case fatality rates at the district hospital, and increasing malaria incidence in the general population. The DHS use data show that 67% of the children less than five years of age (the most vulnerable group for malaria) are currently not reached by the DHS. The po-

TABLE 3  
Assessment matrix for activities associated with malaria control in the Muheza District\*

Activity/strategy	Measurable outcome	Tools/means of verification	Number of activities observed during the study
Delineation (stratification) of the malaria problem, including definition of areas with different levels of endemicity, population at risk, the factors influencing the mosquito borne diseases in different communities	District guideline for malaria control	Number of health facilities using the guideline	None
Outline of measures most appropriate in different villages and their cost effectiveness, their timing and sequencing	Manual for DHMT and dispensary staff	Number of health facilities with the manual	None
Training of health workers on recognition of high-risk situations/populations, selection of measures to apply to different settings and health education	Training of staff	Number of staff trained	10 of 35 staff had received specific job training on malaria in the past 8 years
Understanding of how technically appropriate measures can be organised and how accepted they are within different community settings	A chart showing malaria control approach for each division	Number of health facilities with and using the charts	None of the dispensaries had malaria control charts developed by DHMT. 12 dispensaries had posters on malaria causation and control developed by MOH with no local examples

\* DHMT = District Health Management Team; MOH = Ministry of Health.

tential alternative sources of care for those not reached by DHS include traditional medicines, self treatment, and private dispensaries. However, the coverage of private dispensaries (<10) is mostly confined to the two small towns in the district (Muheza town and Maramba). These findings, in particular the advent of multi-drug resistance to malaria, raise serious concerns regarding DHS effectiveness.

A relatively large part of the training provided in the early 1990s centered on issues related to vaccination, family planning, AIDS control, and record systems. These are the areas that receive the largest donor support within the district. Malaria, although responsible for more than 80% of deaths among the children less than five years of age in some villages within the district, was not given priority. This shows insuffi-

cient needs assessment by those involved in the provision of training, control, and care at the district level.

The lack of a local malaria control strategy in the Muheza District at the time of this review suggests a weak system of translating international and national policies into operational activities at the district and village levels. In the context of the decentralization of health services in Tanzania to the district levels, this implies a weak capacity on the part of district management to develop local and micro-policies that reflect local needs and resources. This is another area that needs to be addressed if the districts are to remain robust entities in dealing with local health problems including malaria in Tanzania.

The Roll Back Malaria Partnership can benefit from the

TABLE 4  
Job training for staff working for district health department: coverage of training, 1995–2002\*

Course title/cadres of staff	Number of medical assistants trained (n = 21)	Number of rural medical aides trained (n = 32)	Number of maternal and child health aides trained (n = 29)	Total number of staff trained	Percentage of the overall staff
Immunization	6	19	23	48	27
Family planning	7	7	21	35	19.6
Essential drugs	7	21	5	33	18.5
Oral health	3	5	10	18	10.1
Maternal and child care	4	5	11	20	11.2
AIDS control	10	24	22	56	31.5
TB and leprosy	4	8	4	16	8.9
Malaria control	—	—	—	—	—
Eye diseases	4	5	3	12	6.7
Laboratory diagnosis	3	4	4	11	6.1
Anemia	4	3	5	12	6.7
Vitamin A deficiencies	5	5	5	15	8.4
Diarrheal diseases	6	8	6	20	11.2
Information system	10	24	22	56	31.5

\* AIDS = acquired immunodeficiency syndrome; TB = tuberculosis.

TABLE 5  
District hospital admissions death rates and malaria case fatality rates, 1989–2002\*

	1989	1990	1991	1992	1993	1994	1995	1996	1998	2000	2002
General admissions	14,025	15,581	10,218	11,117	12,829	12,328	13,966	13,148	14,739	15,361	16,234
Deaths	587	647	638	489	747	587	802	870	912	987	1,015
Death rates per 1,000	41.8	41.5	62.4	44.0	58.2	47.6	57.4	66.2	61.9	64.2	62.5
Malaria admissions	3,803	3,445	3,213	4,855	NA	3,681	4,108	4,899	6,531	6,125	5,891
Malaria deaths	137	145	103	150	132	275	255	332	298	313	335
Malaria fatality rates per 1,000	36	42	32	31	NA	74.7	62.1	67.8	45.6	51.1	56.9
Malaria deaths as a proportion of all hospital deaths	0.23	0.22	0.16	0.31	0.18	0.47	0.31	0.38	0.32	0.32	0.33

\* NA = no records were available.

experience of the integration of malaria control into the district functions in Tanzania. While decentralization is an essential strategy for improving the implementation of malaria control programs because it empowers local authorities and communities to identify their own priorities and needs, a poorly managed decentralization process can ultimately be detrimental to the effectiveness of malaria control programs. In the case of the Muheza District, the structural reorganization did not produce alterations in the way the DHS functioned. There was, therefore, limited success in the reduction of malaria in the district. This appears to be a classic example of a situation in which a distinction needs to be made between structural reorganization on the one hand and the functional integration and implementation on the other. The integration of various activities within a single organization such as DHS does not always lead to desired functional integration. Better strategic planning and monitoring of implementation as well as central support are required, since the district may not have the necessary capacities to achieve the expected objectives for malaria control. Assessment of these capacities and their corresponding development may be crucial to functional effectiveness of DHS and the Roll Back Malaria program in Tanzania and elsewhere.

Finally, the relevance and accuracy of the performance indicators we used in this report can be debated. For example, given the level of resources available to districts such as Muheza, it might seem unfair to expect a district to develop the package of activities addressing the whole range of malaria related issues, from curbing the development of anti-malarial drug resistance to vector control. Furthermore, it is clear from the preceding discussion that any effective malaria control program would require a combination of central and local action. However, it is also clear from the data presented that if the goal of the Roll Back Malaria Partnership, reducing the malaria burden by half by the year 2010, is to be reached, activities implemented at the district level require better coordination and must include a package of strategies, tools, and activities addressing each of the elements reviewed.

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